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settlement of a foundation. For quays the settlement is 10 to 20% of the thickness of the foundation. However, in the actual construction of foundations, this figure was usually exceeded. Settlement usually reaches 15 to 25% of the foundation thickness. When the thickness of the foundation, for example, is three meters, the settlement often reaches 80 centimeters.

The problems thereby posed were the revision of the standards for computing settlement of foundations and also the development of protective operations for reducing settlement caused by the eroding action of the water. This erosion problem was solved by placing a protective layer of stone around the base of the foundation.

- (3) Stacking of blocks. The rules provide that settlement of foundation beds be achieved by bringing a load on the bed of 60% of the maximum calculated pressure anticipated by the project. Such settlement is achieved in practice by building up the foundation until the top surface is almost at the level of water and then stacking a load of stone blocks on this surface. For example, if the maximum load anticipated for a pier is 500 tons, then 60% of this, or 300 tons, of stone blocks would be loaded on the foundation. This method is very expensive and the question was raised of finding a more inexpensive way of settling the foundation.
- (4) Settlement of foundations. Calculations were made to determine the period for which a mass of stones should be stacked on the pier for completing the settlement of the foundation. The construction rules provided that the period of attenuation for average soil be set at two weeks, but there was no distinction drawn for the various types of bottoms such as clay, sand, mud, etc. This shortcoming was corrected by additional calculations for all types of soil.
- (5) Deformation of foundations. Since the rules do not anticipate the phenomenon of deformation of a foundation, plans for observing such an occurrence had to be drafted.
- (f) Corrosive resistance of low-alloy steels SkhL (chrome-nickel-copper) and MG (supramanganese) was studied and their use for fabrication of steel pilings was developed.
- (g) The use of screw-type piles (vintovaya svaya) in hydrotechnical construction was developed. In essence the installation of screw-type piles entails the use of special equipment. The employment of metallic pipes as casings for reinforced concrete piles was adopted as more expedient in hydrotechnical construction than former methods. A screw tip was designed for one end of the pipe to facilitate the sinking of the pipe in the ground. By means of the blades on the tip of the pipe it was screwed in to the depth planned and then filled with concrete. Concrete may or may not be poured into the pipe. This is normally done for large piers, but if the pier is to handle only small ships, then no concrete is used.

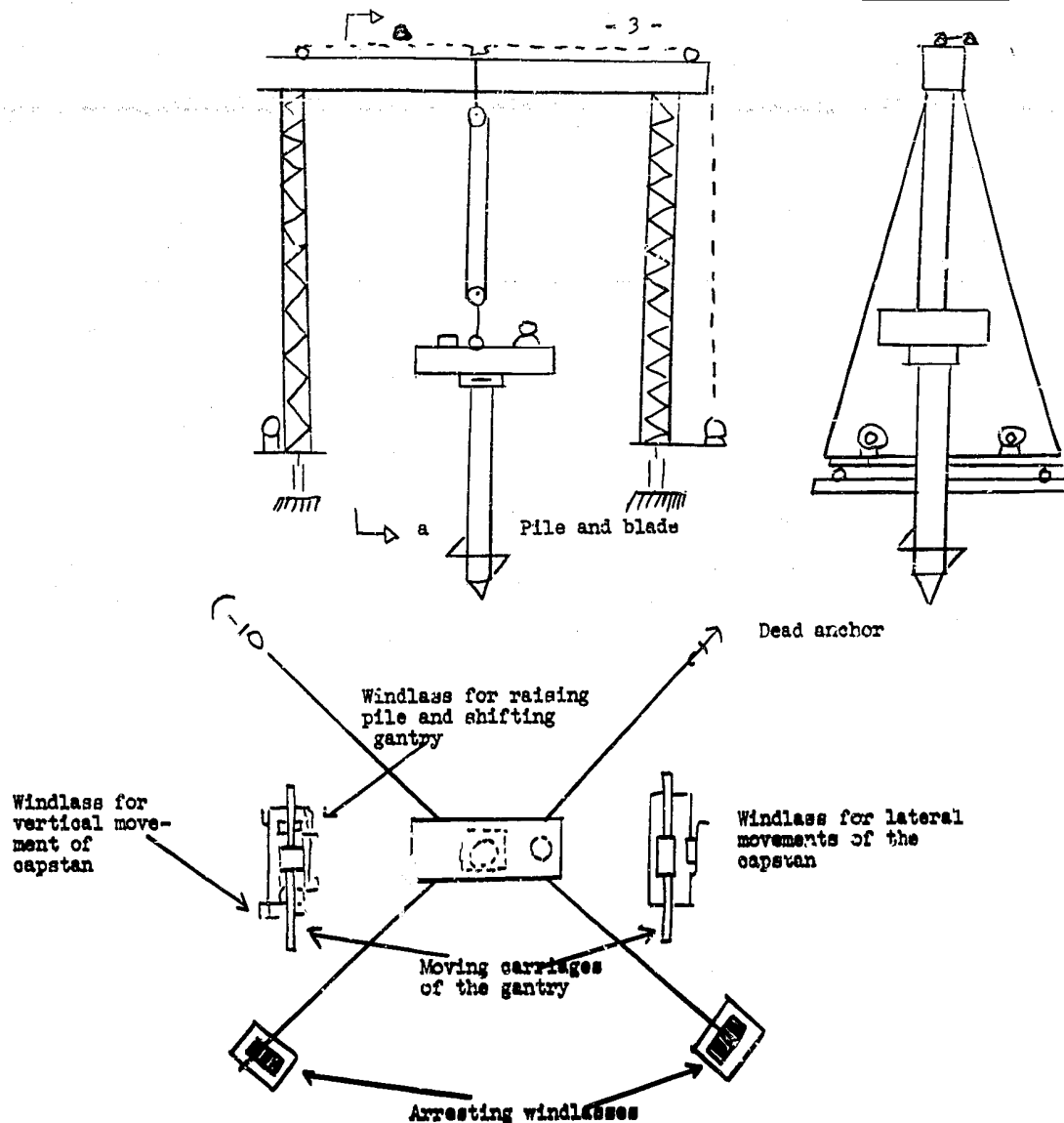
In the construction of the pile, a blade, with a diameter approximately four times the diameter of the pipe, is welded to the lower end of the pipe. The blades are manufactured from sheet steel in the form of a helix. The screw portion of the pile consists of a single thread. The profile, or angle of rise, of the screw depends on the nature of the soil. On the bottom of the pile a shoe (bashmak) in the form of a cone is welded to the butt end (torset) of the pipe. On the upper end of the pile, four sockets (гнездо) are cut out to receive arms which are connected to the rotating, four-way, cross-piece of the capstan. The capstan is actuated by an electric motor through gearing and is suspended from a rolling gantry. The gantry moves on a rail track. In operating position, the capstan (windlass) is mounted directly on top of the pile and is supported thereon by flexible guy wires from the gantry. The platform of the capstan is held rigid by cables from windlasses and dead anchors. Operations can be carried on from light trestles (legkie podmostki) on which rail tracks are installed in movement of the gantry. The driving, or screwing, in of such piles, which normally are twenty meters in length, usually proceeds at a speed of one pile every four hours.

(See following sketch)

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- (h) In 1951 the question of introducing glued piles and sheet-piling was resolved. This matter had to be worked out at once because long measure timber of a large lateral section for piles and sheet-piling was and still is a very critical material in the USSR. GlavMorsStroy developed methods for the fabrication of piles and sheet-piling of any size from short placed planks one meter in length and 40-60 mm in thickness. The moisture of the planks at the time they are glued together must not exceed 15%. The seams of the individual layers of planks are staggered and the external layers of the planks are glued together with miter joints while the inner layers are butt joined.

The planks are glued by water resistant resinous glue, brand KB-3. This glue is made of 100 parts by weight of Resin B and 20-25 parts by weight of a hardner (otverditel'), kerosene KONTAKT (A petroleum sulfonic acid refined from kerosene distillate). Piles and sheet-piling made in this way, retain their durability at temperatures of -20°C . The limit of the shearing strength of glued piles and sheet-piling reaches 65 kg/sq cm. The normal limit of shearing strength for piling has been established by norms and technical specifications at 60 kg/sq cm. The cost of glued piles and sheet-piling is 35-40% cheaper than piles and sheet-piling made of hydrotechnical timber. Glued piles and sheet-piling also are used in the Ministry of the River Fleet and the Ministry of Electric Power Stations (MinElektroStantsiy).

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